DEFINITIVE AND COMPREHENSIVE TECHNICAL REPORT: PROJECT STAR

Synthetic Pulsar (FFF-S) and Silo-Alpha Underground Complex

Feasibility Study: Physics, Nuclear Engineering, Metallurgy, and Civil Infrastructure

EXECUTIVE PROTOCOL: "STAR"

© 2026 Bertolami Salvatore Fabrizio. All rights reserved.
This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0).

1 ABSTRACT AND PROJECT OBJECTIVES

Project **STAR** is an impulsive nuclear transmutation system of the **FFF-S** (Fission-Fusion-Fission-Salting) class. Unlike standard thermonuclear devices, the architecture is optimized to maximize the neutron flux and induce a state of **degenerate matter** (Synthetic Pulsar) within a 250 kg Cobalt-59 target. The ultimate objective is the instantaneous production of Cobalt-60.

2 DEVICE ARCHITECTURE (COMPREHENSIVE BILL OF MATERIALS)

The operational weight of the payload is set at **2,241.2 kg**. The internal geometry is ellipsoidal to ensure a radiative symmetry exceeding 99.9%.

Table 1: BOM (Bill of Materials) - Mass and Material Specifications

Component	**Strategic Material**	**Mass (kg)**	**Physical Function**
Primary Trigger	Plutonium-239 (>93%)	6.2	Radiative trigger (X-ray Flash)
Spark Plug	Uranium-235 (Enriched)	15.0	Secondary thermal ignition
Fusion Fuel	Li6D (Lithium-6 Deuteride)	120.0	Neutron generation (14.1 MeV)
Tamper	Uranium-238 (Natural)	1,200.0	Confinement and fast fission
Salting Target	**Cobalt-59 (Pure)**	**250.0**	**Transmutation Isotope**
Hohlraum	Gold / Beryllium / Lead	550.0	X-ray reflection and Shielding
Internal Structure	Aerogel / Polystyrene	50.0	Photonic channeling
TOTAL PAYLOAD		**2,241.2**	

3 PHYSICAL ANALYSIS OF TRANSIENTS

3.1 Stellar Compression and Fermi Pressure

To trigger resonant transmutation, the core must overcome the electron degeneracy pressure (P_e):

$$P_e = \frac{(3\pi^2)^{2/3}}{5}\frac{\hbar^2}{m_e}\left(\frac{\rho}{m_p}\right)^{5/3} \approx 10^{23} \text{ Pa}$$

- **Peak Density (ρ):** 10^{10} kg/m^3 (Degenerate matter regime).
- **Focal Compression Radius (R):** 1.5 mm.
- **Transient Magnetic Field (B):** 10^7 Tesla (Micro-secondary stabilization).

3.2 Isotopic Saturation Efficiency

The Cobalt-60 yield is defined by the resonant cross-section (σ) and the neutron flux (Φ):

$$N(^{60}Co) = N(^{59}Co) \cdot (1 - e^{-\sigma\Phi t})$$

Given $\Phi \approx 10^{29}$ n/cm^{2}s and $t = 0.5$ ns, the theoretical efficiency is 82% ($\approx$ 205 kg of ^{60}Co).

4 THERMODYNAMIC JUSTIFICATION OF THE TRANSIENT (HEDP)

4.1 Inertial vs. Gravitational Confinement

In stellar degenerate matter regimes, equilibrium is maintained by gravity. Within the domain of High-Energy-Density Physics (HEDP), this function is temporarily fulfilled by mechanical inertia. The radiative ablation of the Uranium-238 tamper (1,200 kg) generates an inward pressure wave that exceeds the outward thermal kinetic expansion pressure by several orders of magnitude.

4.2 Rarefaction Wave Dynamics

Thermodynamic disassembly is not instantaneous but is constrained by the speed of sound (v_s) within the compressed plasma. The useful inertial confinement time (t_c) prior to expansion is:

$$t_c \approx \frac{R}{v_s} \cdot \sqrt{\frac{\rho_{tamper}}{\rho_{core}}}$$

The presence of 550 kg of high-density Gold Hohlraum delays the rarefaction wave, creating a temporal window of 0.5 - 1.0 ns. During this isolated interval, the back-scattering effect driven by the Uranium confines the fast neutrons internally, allowing the flux Φ to reach peaks of 10^{29} before structural vaporization occurs.

5 NANOCHRONOLOGY OF THE DETONATION

1. **T+0 ns: Krytron** switches activated (jitter < 10 ps). EBW detonation of the primary.
2. **T+50 ns:** X-Rays saturate the Hohlraum (5 nm surface finish). Ablation of the Uranium tamper.
3. **T+150 ns: Synthetic Pulsar Phase.** Millimetric compression and collapse into a degenerate state.
4. **T+180 ns:** Neutron flux peak. Massive transmutation of Cobalt-59.
5. **T+200 ns:** Breakdown of inertial confinement. Pair-production fireball (e^-e^+) creation and Gamma expansion.

6 INDUSTRIAL AND ASSEMBLY PROTOCOLS

- **COLEX Process:** Enrichment of Lithium-6 to 95% via Lithium-Mercury chemical exchange.
- **Gold Metallurgy:** The ellipsoidal Hohlraum must be machined with a precision tolerance of **5 nanometers**.
- **Cobalt Machining:** Insertion of Co-59 in nanometric microspheres to maximize the neutron scattering cross-section.

7 CIVIL ENGINEERING: SILO-ALPHA INFRASTRUCTURE

The system requires an underground launch shaft with walls **4.5 meters** thick.

7.1 Wall Stratigraphy

1. **2.5 m - Magnetite Concrete:** High-density composition for magnetic and structural shielding.
2. **0.5 m - Graphite Moderator:** Absorption of spontaneous neutrons emitted by Plutonium-239.
3. **0.2 m - Lead Shielding:** Barrier against background Gamma radiation from the core.
4. **1.3 m - Austenitic Stainless Steel Liner:** Vacuum seal and housing for cryogenic circuitry.

7.2 Technical Support Systems

- **4K Cryogenics:** Liquid Helium circuit for the isotopic stabilization of the Li^6D.
- **Magnetic Levitation:** The module is suspended on an active plate for total seismic isolation up to Magnitude 8.5 (Krytron protection).
- **Vacuum Vessel:** Continuous maintenance of 10^{-7} mbar within the radiation channel.

8 PHENOMENOLOGICAL OUTPUT

- **Energy Yield:** 15 - 25 Megatons.
- **Radiological Activity:** 2.25×10^8 Curies instantaneously vaporized.
- **Gamma Emission:** Specific spectral peaks at 1.17 and 1.33 MeV.
- **Persistence:** Inert exclusion zone for 50 years.

Study and calculations performed by Bertolami Salvatore Fabrizio – 03/25/2026